



EXAMINING THE GRADUAL INTEGRATION OF ARTIFICIAL INTELLIGENCE IN HEALTHCARE: LIMITATIONS AND BARRIERS TO COMPLETE AUTOMATION

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ABSTRACT

The rapid advancement of artificial intelligence (AI) is transforming various industries, notably healthcare, where automation presents both opportunities and concerns. While AI has the potential to enhance efficiency and accuracy in medical practices, it also raises ethical issues like trust, data privacy, and the necessity of maintaining a human touch in caregiving. Addressing these concerns is vital for fostering informed discussions that shape policies and practices, ensuring that technological progress complements the human aspects of healthcare. This raises the question: How would the rapid advancement of AI lead to the partial or complete automation of specific medical tasks and roles, and what practical limitations and barriers might hinder the widespread adoption of AI-driven automation in the healthcare sector?

This paper introduces a sociological element to discuss the machines and the humans involved in healthcare's giving and receiving ends. The hypothesis suggests that AI's integration into healthcare will likely be gradual and partial due to factors like human behavior, technical errors, and consumer preferences. The structure includes a review of literature on AI applications and challenges, followed by a detailed methodology featuring structured interviews with healthcare professionals and observations from a summer volunteering experience in a hospital. These insights reveal attitudes and concerns surrounding AI's role in medical settings. Ultimately, while AI promises to enhance healthcare efficiency, successful implementation depends on navigating the complexities of human interaction and trust. As we move forward, fostering open dialogue and education will be essential for aligning technological advancements with the vital human elements of patient care.

KEYWORDS: Artificial Intelligence (AI), Automation, Healthcare, Consumer Attitudes, Job Displacement.

INTRODUCTION

The rapid advancement of artificial intelligence (AI) technology is generating widespread discussions about automation across industries, with a particular focus on the highly regulated and complex healthcare sector. As AI systems evolve, their potential to automate specific medical tasks currently performed by healthcare providers is gaining significant attention (Lee & Yoon, 2021). AI has already begun reshaping the workforce in fields like manufacturing, logistics, customer service, and administration by taking on tasks that require extensive data processing and decision-making capabilities, often beyond human cognitive capacities.

In healthcare, AI offers transformative possibilities to automate and support tasks traditionally performed by humans. However, understanding AI's capabilities and limitations is essential to ensuring that its integration enhances operational efficiency while addressing ethical concerns and preserving the indispensable role of human expertise. Although AI can assist healthcare professionals by streamlining certain processes, the industry's complex demands suggest that human knowledge and judgment remain critical (Haleem et al., 2019). This raises the question: To what extent could the integration of AI lead to the partial or complete automation of specific medical tasks, and what practical limitations and barriers might hinder the widespread adoption of AI-driven automation in healthcare?

This paper will evaluate AI's potential to automate routine medical tasks while examining factors such as diagnostic accuracy, patient trust, and the complexity of medical decision-making that impact AI's integration into healthcare.

LITERATURE REVIEW

Applications and Advantages

Recent advancements demonstrate that AI can automate routine tasks, such as analyzing medical images, managing medication schedules, and aggregating patient data. This enables healthcare providers to dedicate more time to complex tasks that require human judgment and empathy. The World Health Organization has noted that approximately 60% of health factors are linked to lifestyle choices, such as exercise, diet, and stress management (Bores, 2010). Researchers are exploring AI's potential to provide personalized lifestyle interventions and real-time reminders via digital devices, empowering individuals to manage their health and chronic conditions effectively (Abe & Abe, 2019).

AI is also transforming healthcare operations, particularly in medical imaging and diagnostics. For instance, deep learning algorithms accurately identify anomalies and detect early signs of cancer, thereby enhancing healthcare professionals' diagnostic capabilities. Additionally, AI aids in precision medicine by analyzing large genomic and clinical datasets, uncovering patterns, and identifying tailored treatment options

(Rayhan, 2023). Overall, AI is revolutionizing not only how we diagnose and treat illnesses but also how we approach health and well-being.

Practical Challenges and Limitations

Despite these advancements, AI integration in healthcare faces practical challenges and limitations. The medical field is highly regulated, with strict requirements for testing, validation, and approval of new technologies to ensure patient safety and uphold ethical standards. Studies at medical centers in South Korea have shown varying agreement rates between AI systems (e.g., IBM's Watson) and human physicians, ranging from 40% for Stage IV stomach cancer to 55.9% for overall medical treatment evaluations (Somashekhar et al., 2016). In posts expressing negative attitudes toward AI in medical care, 45.8% of respondents cited the immaturity of AI technology as a primary concern. Many believe that AI faces technical challenges, such as obtaining high-quality medical data and standardizing complex medical treatments (Gao, 2020). Additionally, 25.4% of respondents reported distrust toward AI companies, fearing a focus on profit over patient well-being, which has led to concerns about substandard hospital recommendations (Gao, 2020). Further, 11.9% expressed a fear of AI technology, and 8.5% noted a perceived lack of "enthusiasm" for AI, highlighting concerns over its humanistic aspects (Gao, 2020).

Human Behaviors Towards AI Application

- **Positive Attitudes:** AI's technical advantages, including diagnostic accuracy and computational efficiency, have fostered positive attitudes toward its use in healthcare. A study revealed that 44.2% of respondents highlighted these benefits, while 40.3% expressed optimism regarding future developments in medical AI, indicating general confidence in industrial advancements (Gao, 2020).
- **Negative Attitudes:** Conversely, some individuals harbor negative attitudes due to AI's perceived immaturity. About 45.8% of respondents questioned AI's current capabilities, citing challenges in accessing high-quality medical data and standardizing treatments (Gao, 2020). Distrust of AI companies was also evident, with 25.4% of respondents concerned that profit motives might overshadow patient care (Gao, 2020). Smaller groups voiced fears regarding the implications of AI technology (11.9%) and raised ethical concerns about privacy and legal oversight (3.4%) (Gao, 2020).
- **Attitudes Toward AI Replacing Human Doctors:** The potential of AI to replace human doctors is a contentious topic. Approximately 80.0% of posts discussing this issue suggested that AI might fully or partially replace human practitioners, with 47.5% believing AI could entirely supplant doctors due to technical advantages, such as accuracy and efficiency (Gao, 2020). Specific roles, including those of pathologists, radiologists, and dermatologists, were seen as most susceptible to replacement. However, 20.0% of posts opposed this view, arguing that limitations in AI technology, the need for humanistic interaction, and ethical concerns would prevent a complete replacement of doctors by AI (Gao, 2020).

Impact on Human Workforce: Economic Stability and Livelihood

Healthcare workers express significant concerns about AI's impact on their economic stability and livelihoods. Many participants highlighted the potential disruption to career paths and financial security, emphasizing the substantial investments they have made in medical education (Rony et al., 2024). These findings stress the importance of addressing economic concerns and developing support systems that enable healthcare professionals to coexist with advancing technology.

In summary, the literature indicates a nuanced view among healthcare professionals regarding AI integration in their field. While there is recognition of AI's potential to complement human skills, fears about economic stability and technological displacement remain prevalent. Addressing these concerns while fostering trust in AI will be critical to shaping a future where technology and healthcare professionals work together effectively. Despite AI's capacity to automate specific medical tasks, its integration in healthcare will likely proceed gradually and partially due to human behaviors, technical errors, and consumer preferences.

METHODOLOGY

Overview of Experiments

This research consisted of two primary experiments aimed at understanding the impact of artificial intelligence (AI) within the medical field. The first experiment involved structured interviews with various healthcare professionals, while the second included active participation in medical roles through a summer hospital volunteering program. This dual approach facilitated a comprehensive understanding of AI's application in healthcare settings.

Experiment 1: Structured Interviews

The first experiment comprised interviews with a diverse group of healthcare professionals, including physiotherapists, rehabilitation specialists, radiotherapists, nurses, doctors, pharmacists, and other medical staff across multiple departments such as Accident and Emergency (A&E) and operational rehabilitation. Additionally, interviews were conducted with consumers of healthcare services, acknowledging the importance of understanding users' perspectives and views regarding this change.

Interview Protocol

A series of open-ended questions were designed to elicit insights into the participants' experiences and perceptions of AI in their respective fields. The research questions were organized into two main categories:

General Tasks:

1. What department do you work in?
2. What types of work do you perform?
3. Which of these tasks are repetitive?
4. How much time do you dedicate to these repetitive tasks each day?
5. Do you believe these repetitive tasks could be replaced by AI or robots?

Consumer Behavior:

6. How would you feel if robots conducted your surgery or administered an injection?
7. Are you comfortable with the idea of hospital roles being performed by robots or managed by AI? Why or why not?

Variable Definitions

- **Independent Variable:** The department in which the healthcare professional works.
- **Dependent Variable:** Individual opinions and experiences regarding AI, as gathered through the interviews.
- **Control Group:** All participants were required to be actively involved in the medical field, ensuring the sample was relevant to the research focus.

The chosen questions aimed to explore both the practical aspects of daily medical tasks and the emotional and ethical considerations surrounding AI in healthcare. This dual focus was intended to gather a holistic view of the participants' perspectives and experiences.

Experiment 2: Volunteering Experience

The second experiment involved active participation in various medical roles through a summer hospital volunteering program. This hands-on experience allowed for direct observation of AI applications in clinical settings, providing a practical context to complement the insights gained from the interviews. Throughout the volunteering period, observations were recorded regarding the integration of AI technologies in different departments. These observations included noting the types of tasks automated by AI and the overall impact on workflow and patient care.

Methodology Justification

The structured interviews in this research provide diverse perspectives from healthcare professionals and consumers, offering valuable insights into the practical applications, challenges, and ethical considerations surrounding AI in healthcare. By capturing the experiences of various roles—such as doctors, nurses, and patients—these interviews reveal nuanced opinions and emotional responses that highlight the impact of AI on tasks, patient care, and the patient-provider relationship.

In contrast, the real-life experience gained through volunteering in a hospital setting offers practical observation of AI integration in action. This hands-on involvement enables researchers to understand the complexities of healthcare workflows and the specific applications of AI technologies, such as automated data management and diagnostic tools.

RESULTS

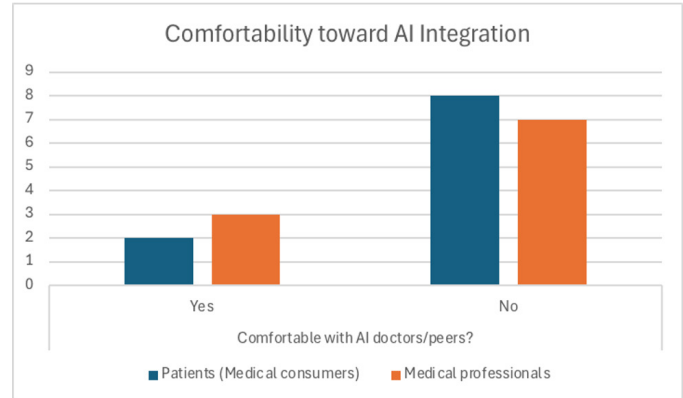


Figure 1: Comfortability towards AI Integration

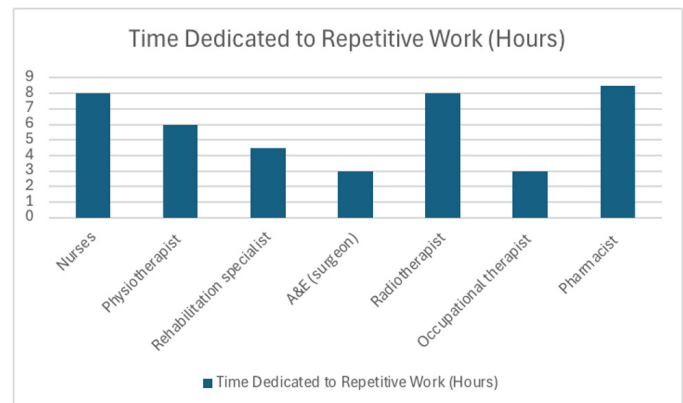


Figure 2: Time Dedicated to Repetitive Task (Hours)

Occupations	Repetitive task? If yes, can it be replaced by AI? (The table displays a generalized review of each occupation's participant's response.)
A&E	Not entirely, as accident scenarios vary significantly, requiring surgical doctors to adapt to unique conditions each time.
Nurse	Yes, tasks such as preparing patients' daily needs, administering injections, and ensuring medication intake could be automated.
Physiotherapist	Partially; while treatment planning is repetitive, each patient's situation necessitates unique approaches.
Pharmacy	Yes, dispensing medications and providing drug-use information are largely repetitive and suitable for automation.
Radiology	Yes, although professional knowledge is essential for scan analysis, much of the work is routine.
Occupational therapy	Partially; while treatments follow repetitive patterns, adjustments are made for individual patient needs.
Rehabilitation specialist	Not entirely; treatment methods are consistent in structure but require adaptation to individual patient requirements.

Table 1: Time Dedicated to Repetitive Task (Written Response)

Qualitative Response

The first experiment analyzed consumer and healthcare professional attitudes toward integrating artificial intelligence (AI) into healthcare. Patients expressed significant concerns about AI's role in medical care, with trust in its accuracy and data privacy being primary apprehensions. Many voiced discomforts with AI performing surgeries or other critical tasks, citing fears of job displacement and the potential loss of human interaction essential for trust and empathy.

Healthcare professionals shared similar reservations. Most were uneasy about collaborating with AI as peers, emphasizing that effective communication and emotional intelligence are vital to patient care—qualities they believe AI lacks. Dr. Chan, a senior surgical doctor, highlighted these concerns in an interview, noting that while the hospital uses AI for administrative tasks and symptom analysis, it faces practical barriers in integrating AI into areas like surgery. He pointed out that current AI technologies cannot yet guarantee the safety and accuracy required in complex medical procedures. However, Dr. Chan remained optimistic about AI's potential for partial or complete automation in specific medical roles over time.

Observational Insights

The second experiment, involving hands-on hospital volunteering, provided direct exposure to AI's application in healthcare workflows. AI significantly improved patient registration processes, streamlining intake, reducing wait times, and minimizing human errors. Additionally, automated scheduling systems optimized appointment bookings, enhancing convenience for both patients and staff while managing patient flow more effectively.

Another observed application was in medication payments, where AI systems improved transactional efficiency and ensured accurate billing. These advancements demonstrated how AI integration, even in administrative and logistical roles, could enhance operational efficiency and service delivery in healthcare settings.

DISCUSSIONS

The findings from this study underscore the complex interplay between consumer and healthcare professional attitudes toward the integration of artificial intelligence (AI) in the medical field. The initial hypothesis posited that, while AI has the potential to automate specific medical tasks, its integration would likely be gradual and partial, influenced by human behaviors, technical errors, and consumer preferences. The results supported this hypothesis, revealing significant concerns among both patients and medical professionals.

Medical Workers' Attitudes

Medical professionals expressed notable discomfort with AI as a peer, emphasizing concerns over job displacement and implications for patient care. Dr. Chan's insights highlight the complexities involved in medical decision-making, particularly in surgical settings, where reliance on AI could introduce risks if the technology fails to ensure accurate diagnoses or outcomes. This sentiment aligns with the broader attitudes

among healthcare workers in the study, who fear that AI might undermine the essential human element of patient care. These concerns indicate a broader resistance to change within the medical community, driven by perceived threats to traditional roles and the quality of patient interactions.

Consumer Attitudes

Consumer attitudes toward AI integration were similarly cautious. Many patients voiced apprehensions about AI's role in managing their healthcare, citing issues of trust, accuracy, and data privacy. This discomfort reflects a wider societal hesitation to fully embrace emerging technologies. However, observations from my volunteering experience revealed a gradual shift as patients became more familiar with AI tools for tasks like online diagnoses and appointment scheduling. While initial reactions were often negative, repeated exposure to these technologies helped alleviate some concerns, suggesting that consumer acceptance of AI could increase over time with proper education and familiarity.

Practical AI Integration

The study's findings also highlight the practical aspects of AI integration in healthcare. As noted by Dr. Chan, AI has already been incorporated into administrative tasks such as patient registration, appointment scheduling, and medication payments. These applications demonstrate AI's potential to enhance operational efficiency and reduce the burden of repetitive tasks on healthcare workers. My observations during volunteering further support this, as I witnessed firsthand how AI can streamline processes and improve patient flow. This shift in attitude suggests that, as patients experience the benefits of AI in areas like appointment scheduling and online diagnostics, their trust and comfort levels are likely to increase. However, transitioning to more complex applications of AI, particularly in diagnostic and treatment contexts, will require overcoming significant barriers.

Summary of Findings

In summary, the results of this study indicate that, while AI is making inroads into the medical field, its integration will likely be gradual and partial. The concerns raised by both consumers and healthcare professionals highlight the necessity of addressing issues related to trust, accuracy, and human interaction. Despite the challenges, my experience suggests a growing acceptance of AI in routine tasks, paving the way for broader adaptation in the future. As AI technologies continue to evolve, they hold great potential to enhance patient care and operational efficiency, provided the healthcare community actively engages with these concerns and educates both patients and providers on their benefits. Overall, the findings affirm the hypothesis that, while AI can automate certain tasks, integrating AI in healthcare will require a careful balance that respects human needs alongside technological limitations.

CONCLUSION

The integration of AI in healthcare offers both opportunities and challenges. While AI can automate routine tasks and improve efficiency, its adoption may be slow due to concerns about accuracy, trustworthiness, and reduced human interaction.

Medical professionals worry about job displacement and the complexities of decision-making, while patients have concerns about data privacy and AI's role in managing their healthcare. Despite these worries, acceptance of AI is growing, particularly in administrative roles. Insights from volunteering indicate that familiarity with AI can help alleviate initial fears. The research highlights significant concerns about trust, job displacement, and the loss of personal touch in patient care, supported by a literature review that reflects a mix of optimism and skepticism about AI's capabilities and employment impacts. Balancing technological advancements with human elements is essential for enhancing healthcare delivery while preserving personal connections.

Understanding AI's integration in healthcare is crucial for shaping the future of patient care and healthcare roles. As AI technologies evolve, they promise increased efficiency and accuracy but raise ethical concerns around trust, data privacy, and the human touch in caregiving. Addressing these issues is vital for fostering informed discussions that shape policies and practices, ensuring that advancements improve healthcare while respecting essential human elements. In conclusion, AI has the potential to enhance healthcare efficiency, but its integration will be gradual, requiring strategies to build trust and address stakeholder concerns.

Limitations and Future Directions

While AI can revolutionize healthcare by automating routine tasks, significant limitations remain. Key concerns include patient apprehension about machines handling critical tasks and healthcare professionals' fears of job displacement and skepticism regarding AI's grasp of human nuances. Additionally, inconsistent data collection practices can hinder AI's effectiveness. To address these challenges, enhancing training for healthcare professionals can improve acceptance, while ongoing improvements in AI systems are necessary for reliability and ethical considerations. Building patient trust through transparent communication and personalized healthcare experiences is crucial, as is fostering collaboration among AI developers, providers, and policymakers. Establishing clear regulations and incentives can promote faster AI adoption, allowing the healthcare sector to better embrace its transformative potential.

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